

AMENDMENT UNDER 37 C.F.R. § 1.116
U.S. Application No.: 10/050,518

IN THE CLAIMS:

1. (currently amended): A membrane electrode assembly comprising a pair of opposing electrodes each having a catalytic layer, and a polymer electrolyte membrane sandwiched by said electrodes, part of said catalytic layers being projecting into said polymer electrolyte membrane, wherein the projection depth of said catalytic layer is 0.5 μm or more and less than 5 μm , ~~and wherein when there are arbitrary two points, whose linear distance is 10 μm or more, in an interface of said polymer electrolyte membrane with each of said catalytic layers, the distance along said interface is longer than said linear distance by 15% or more on average.~~

Claim 2. (canceled)

Claim 3. (canceled).

4. (original): The membrane electrode assembly according to claim 1, wherein the DC resistance of said polymer electrolyte membrane in a thickness direction determined by impedance measurement is 90% or less of the DC resistance of a membrane electrode assembly having the same structure except that part of catalytic layers do not project into a polymer electrolyte membrane.

5. (original): A membrane electrode assembly comprising a polymer electrolyte membrane, said polymer electrolyte membrane having a softening point of 120°C or more and a Q value of 0.09-0.18 C/cm².

AMENDMENT UNDER 37 C.F.R. § 1.116
U.S. Application No.: 10/050,518

6. (original): The membrane electrode assembly according to claim 5, wherein said membrane electrode assembly has a structure in which said polymer electrolyte membrane is sandwiched by a pair of opposing electrodes each having a catalytic layer, part of said catalytic layers projecting into said polymer electrolyte membrane.

7. (original): The membrane electrode assembly according to claim 6, wherein the projection depth of said catalytic layers into said polymer electrolyte membrane is 0.5 μm or more and less than 5 μm .

8. (original): The membrane electrode assembly according to claim 6, wherein when there are arbitrary two points, whose linear distance is 10 μm or more, in an interface of said polymer electrolyte membrane with each of said catalytic layers, the distance along said interface is longer than said linear distance by 15% or more on average.

9. (original): The membrane electrode assembly according to claim 6, wherein the DC resistance of said polymer electrolyte membrane in a thickness direction determined by impedance measurement is 90% or less of the DC resistance of a membrane electrode assembly having the same structure except that part of catalytic layers do not project into a polymer electrolyte membrane.

10. (currently amended): A membrane electrode assembly comprising a pair of opposing electrodes each having a catalytic layer, and a polymer electrolyte membrane sandwiched by said electrodes, part of said catalytic layers being projecting into said polymer electrolyte membrane, wherein the projection depth of said catalytic layer is 0.5 μm or more and less than 5 μm ,

AMENDMENT UNDER 37 C.F.R. § 1.116
U.S. Application No.: 10/050,518

~~wherein when there are arbitrary two points, whose linear distance is 10 μm or more, in an interface of said polymer electrolyte membrane with each of said catalytic layers, the distance along said interface is longer than said linear distance by 15% or more on average, and~~

wherein said polymer electrolyte membrane is made of a sulfonated hydrocarbon polymer that may contain oxygen in its skeleton or other substituent groups than a sulfonic group, wherein the sulfonated hydrocarbon polymer is selected from the group consisting of sulfonated polyetheretherketone, sulfonated polysulfone, sulfonated polyethersulfone, sulfonated polyetherimide, sulfonated polyphenylene sulfide and sulfonated polyphenylene oxide.

Claim 11. (canceled)

12. (previously presented): The polymer electrolyte fuel cell constituted by stacking a plurality of said membrane electrode assemblies according to claim 1 via separator plates.

13. (withdrawn): A method for producing a membrane electrode assembly by bonding catalytic layers of a pair of opposing electrodes to both surfaces of a polymer electrolyte membrane, comprising the steps of (1) coating a catalytic layer of one electrode with a solution of a polymer electrolyte in an organic solvent, (2) coating the resultant polymer electrolyte membrane with a catalyst slurry for the other electrode, while the amount of said organic solvent remaining in said polymer electrolyte membrane is 5-20 weight % based on said polymer electrolyte membrane, and (3) after drying, hot-pressing said polymer electrolyte membrane and said electrodes formed on both sides of said membrane.

AMENDMENT UNDER 37 C.F.R. § 1.116
U.S. Application No.: 10/050,518

14. (withdrawn): A method for producing a membrane electrode assembly comprising a polymer electrolyte membrane having a softening point of 120°C or higher and a Q value of 0.09-0.18 C/cm², comprising the steps of (1) forming said polymer electrolyte membrane from a solution of said polymer electrolyte, (2) hot-pressing said polymer electrolyte membrane and a pair of electrodes arranged on both sides of said membrane, while the amount of said organic solvent remaining in said polymer electrolyte membrane is 3-20 weight % based on said polymer electrolyte membrane, and then (3) drying said polymer electrolyte membrane.

15. (withdrawn): The method for producing a membrane electrode assembly according to claim 14, wherein said organic solvent is N-methylpyrrolidone.

16. (previously presented): A membrane electrode assembly comprising a polymer electrolyte membrane, said polymer electrolyte membrane having a softening point of 120°C or more and a Q value of 0.09-0.18 C/cm², wherein said polymer electrolyte membrane is made of a sulfonated hydrocarbon polymer that may contain oxygen in its skeleton or other substituent groups than a sulfonic group, and wherein the sulfonated hydrocarbon polymer is selected from the group consisting of sulfonated polyetheretherketone, sulfonated polysulfone, sulfonated polyethersulfone, sulfonated polyetherimide, sulfonated polyphenylene sulfide and sulfonated polyphenylene oxide.

17. (previously presented): The polymer electrolyte fuel cell constituted by stacking a plurality of said membrane electrode assemblies according to claim 5 via separator plates.